



## Role of Bitemarks in Forensic Investigations: An Overview

**Dr. Kusum Singal**

B.D.S, MSc. ( Forensic Science), Senior Research Fellow (SRF),  
AIIMS, New Delhi

### ABSTRACT

Bite marks plays a very important role in the field of forensics. As every individual has a unique pattern of dentition, that's why dental prints or the injuries caused by teeth provide a individual mark for identification. This article basically describes what are bite marks, classification of bite marks and method of their analysis in brief.

### KEYWORDS

Bite marks, Analysis, Biter, Tissue, Tooth pressure, Material

### INTRODUCTION

Forensic sciences are multidisciplinary team efforts relying on positive identification methodologies as well as presumptive or exclusionary methodologies. In Civil Courts, identification of deceased persons may be required for insurance, pension, inheritance claims, marriage, disputed sex and missing persons. In Criminal Courts, it is essential in cases such as persons accused of assault, rape, murder, etc. Accurate identification is mandatory in forensic sciences.

The main aspects of forensic dentistry include; dental identification, age and sex estimation of an individual from teeth, identification in mass disasters, identification from bite marks lip prints and blood groups etc.

### BITE MARKS

Injuries induced by teeth and left on objects, such as skin, have a distinctive pattern and these patterned injuries are called as bite marks. These patterned injuries are useful to judicial authorities because they help in reconstructing past events that surrounded the biting process. For example, bite marks indicate a violent interaction between the perpetrator and the victim, and they might tell us something about the criminal intentions of the perpetrator, whether sexual, child abuse, or other forms of assaults. Moreover, bite marks are the only patterned injuries that can indicate (with different levels of certainty) who the biter was. By comparing the locations and measurements of teeth marks in a bite mark with those of the suspect(s), Forensic Odontologists can exclude or include persons suspected of causing the bitemarks<sup>1</sup>.

### HISTORY

Several notable early bite-mark cases include the 1870 Ohio vs Robinson case; a 1906 case in Paris, in which the bite was in cheese and use of overlays by Stroup in 1924. Since, the 1950s, bite-mark evidence and dentists have played a role in the judicial system. The ability to discern the biter from the patterned injury he leaves in skin is a relatively new science, having made its first significant appearance in American courts in 1972.<sup>2,3</sup>

### ANALYSIS OF BITE MARKS

During the process of bite-mark analysis, the unique characteristics of a suspected biter's dentition are compared with the patterns observed in the bitten skin. In a bite mark analysis, two simultaneous and opposite paths develop<sup>4</sup>

The inclusive path is one in which the unique features of a suspected biter's dentition show a strong and consistent linking in a tooth-by-tooth and arch-to-arch comparison with the pattern recorded in the bitten skin. This linking is usually the strongest with a biter possessing a profoundly irregular den-

titution and a bite mark pattern in the skin that has recorded clear and distinct individual tooth patterns<sup>4</sup>.

The exclusive path is one in which the suspected biter's dentition does not show linking with the patterns recorded in the bite mark injury in an arch-to-arch and tooth-by-tooth analysis. In this case, the biter would be excluded as being responsible for causing the Bite Mark<sup>4</sup>.

### FACTORS INFLUENCING BITE MARKS<sup>5</sup>

- 1. Type of tissue:** In the case of skin, if it is loose or with excessive fat bites commonly produce bruising leading to poor definition, whereas in areas of fibrous tissue or with high muscle content tend to bruise less, so that the definition of bite mark is good.
- 2. Age:** Infants and old individuals bruise more than other age groups.
- 3. Sex:** Female tends to bruise more than males. Once produced bite marks will be evident for longer period of time in female compared to males.
- 4. Medical status:** People having bleeding disturbances, under anticoagulant therapy and certain skin disease bruises more.
- 5. Time:** The time elapsed between actual biting and when the impression is made is vital. Depression produced in the skin due to bite marks will recover within 10 - 20 minutes leaving swelling and discoloration. After death skin tends to contract, harden and decompose.
- 6. Vascularity:** The intensity of discoloration may depend on vascularity of the area. Bruises will occur and last on a more vascular area like face than in the site which is less vascular like bite on hand or foot.
- 7. Histopathologic changes:** Histopathological changes according to the age of bite mark in the skin are given below:

Time (Hours)	Predominant cells and deposits	Healing	Clinical Order
4 - 8	PMNL	--	Red / blue / purple
12	PMNL	--	--
16 - 24	Macrophages	Peripheral fibrosis	Blue to Black
24 - 36	PMNL	--	--
Days			
1 - 3	Central necrosis	--	Green to blue
3 +	Hemosiderin	Collagen fibers	--
4	--	Capillary growth	Brown to Yellow green
4 - 5	--	Lymphocytes	--
10 - 14	--	Granulation tissue	Tan yellow

## CLASSIFICATION OF BITE MARKS

Bite marks can be classified in many types depending upon different factors.

### A) Robertson and Hodge classification have classified the aging of human bites into four stages.

- Stage - 1** - Scab formation (0 to 18 hours)  
**Stage - 2** - Epithelial regeneration (30 to 70 hours)  
**Stage - 3** - Sub epidermal granulation (5 - 12 days)  
**Stage - 4** - Regression (After 12 days)

### B) Cameron and Sims' classification:

A simple classification based on the type of agent producing the bite marks and material exhibiting it.

**Agent:** Human and Animal

**Materials:** Skin, body surface, food stuff, other materials<sup>5</sup>

### C) MacDonald's classification of bite marks:<sup>6</sup>

- 1. Tooth pressure marks** - Tooth pressure marks are caused by incisal edges of the anterior teeth. They are stable and subjected to minimal distortion.
- 2. Tongue pressure marks** - Because of the tongue pressure, impressions of the palatal surfaces of the teeth, cingulae or palatal rugae may be produced. This causes distortion of the marks.
- 3. Tooth surface marks** - Scrape marks are produced because of irregularities in the teeth due to fractures, restorations etc.
- 4. Complex marks** - Combination of the above types of marks.

## BITES IN HUMAN TISSUE

The scientific examination of bite-mark evidence is interesting and tough. The force required to penetrate the skin is considerable, and bites showing laceration of the tissue are necessarily aggressive in nature. Identification of humans using the unique features of the teeth and jaws has been used since Roman times. The assailant may suck the soft tissues into the mouth so that images of the palatal surfaces of the teeth as well as of the incisal edges may appear. The forces required may result in petechial haemorrhages in the centre of the wound. All of these features must be analyzed in describing the mark. Less aggressive bites may not penetrate the skin but will leave a partial or complete oval marks relating mainly to the anterior teeth (canine to canine). During biting, the victim (if alive) and the assailant will frequently be struggling so that teeth may produce scrape marks before the tissue is finally bitten. The tissue is flexible and is distorted during the bite. If the bite is on a living person there will be post injury changes in the tissue, resulting in bleeding, swelling, and discoloration. In a dead individual there may be post-mortem changes that complicate the analysis of the mark. It is important to photograph the mark with standardized techniques. Special scales

with imprinted marks have been produced for this purpose to allow the degree of distortion of the photographic image to be determined. A report should be prepared at this early stage before any suspects are interviewed so that no bias is introduced into the analysis of the mark. Transparent photographic overlays are prepared from these study casts at the same scale as that located over the bite mark and arranged so that one can compare the characteristics of the dentition and the bite mark. Unless the bite is unusually clear and possesses characteristics that are unlikely to occur in more than one dentition, it is safer to exclude suspects through these techniques rather than to implicate them.<sup>7</sup>

## BITES IN OTHER MATERIALS

Criminals may, from time to time, leave their dental signature in bitten apples, chocolate, cheese, or other foods left at the scene of a crime. There are cases in which assailants have bound victims with adhesive tape and torn off section of the tape with their teeth, leaving identifiable bite marks on the tape. The same principles of analysis apply as in the case of tissue bites, but bites in artificial substances of foods can often yield more information because of the lack of distortion of the material and its ability to make a good impression of the biting edges of the teeth. In all types of bites, it is important that, before the materials are handled, swabs are taken to test for possible salivary contamination because this step may reveal the blood group of the assailant. If the saliva contains intraoral cellular material, DNA analysis may be possible.<sup>7</sup>

## METHODS OF BITE MARK ANALYSIS<sup>8</sup>

**Vectron:** Vectron is used to measure distances between fixed points and angles.

**Stereometric graphic analysis:** This can be used to produce contour map of the suspect's dentition.

**Experimental marks:** Experimental bite marks may be produced on the pig skin, bakers dough or rubber for analysis.

**Scanning electron microscopy (SEM):** Adjunctive use of SEM demonstrated the presence of unusual three-dimensional characteristics in a bite mark. Despite the fact that many bite marks do not show "depth," demonstration of the presence of this third dimension can produce significant data for evidentiary purposes.<sup>7</sup>

## REFERENCES

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